

Endovascular Coiling of Multiple (More than Four) Intracranial Aneurysms

Case Report

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Summary

The incidence of multiple intracranial aneurysms has been reported from 5% to 35%. But over four multiple aneurysms are extremely rare. Sometimes it is very difficult to draw a clear line between ruptured ones and unruptured others especially in multiple aneurysm cases with even distribution of subarachnoid haemorrhage on basal cistern. We present two cases of multiple aneurysms, more than four, which were successfully treated by endovascular coiling at the same time. Our experience suggests an endovascular procedure would be the gold standard of treatment for ruptured multiple intracranial aneurysms.

Introduction

The frequency of multiple intracranial aneurysms ranges from 5% to 35% depending on completeness of diagnostic procedure^{2,7,11,15}.

Among multiple intracranial aneurysms, two or three aneurysms occupy about 70% and 30% respectively¹⁰. Over four numerous aneurysms are extremely rare¹⁰.

The introduction of GDC has made it possible to treat aneurysms effectively by endovascular methods. In aneurysms less suitable for surgical clipping, GDC has been shown to be a feasible alternative modality to clipping. The

best treatment of numerous aneurysms are occlude all aneurysms. Recently, we experienced two cases above four numerous intracranial aneurysms treated by endovascular coiling successfully. Our experience suggests that endovascular method is particular suitable for treating numerous intracranial aneurysms.

Case Reports

Case 1.

An 82-year-old woman was transferred from another hospital with stuporous mental state. Brain computed tomography (Brain CT) showed Fisher grade IV subarachnoid haemorrhage with intracerebral haemorrhage in right sylvian portion (figure 1). Digital subtraction angiography (DSA) revealed four intracranial aneurysms, including two right middle cerebral artery (MCA), one anterior communicating artery (ACoA) and one left A2 portion of anterior cerebral artery (ACA) aneurysms (figure 1). The size of the aneurysms were 9 x 10 mm and 4 x 5 mm in right two MCA respectively, 7 x 6 mm in ACoA, and 8 x 8 mm in left A2 portion of ACA. We expected that ruptured aneurysm was the right larger MCA aneurysm because of its large size and right sylvian haemorrhage in brain CT. In treatment options, we selected the endovascular method because multiple surgical approaches during acute phase was a contribut-

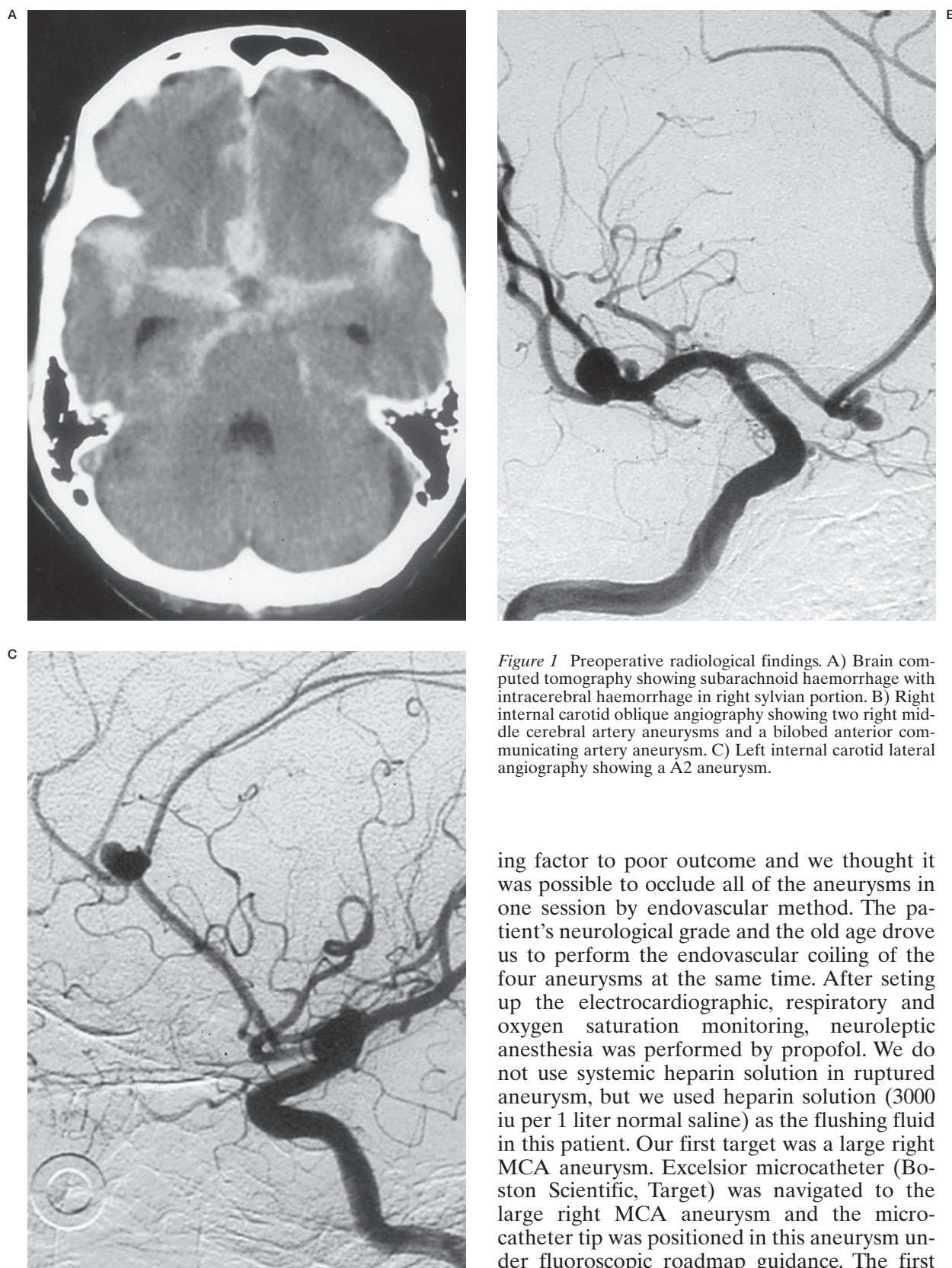


Figure 1 Preoperative radiological findings. A) Brain computed tomography showing subarachnoid haemorrhage with intracerebral haemorrhage in right sylvian portion. B) Right internal carotid oblique angiography showing two right middle cerebral artery aneurysms and a bilobed anterior communicating artery aneurysm. C) Left internal carotid lateral angiography showing a A2 aneurysm.

ing factor to poor outcome and we thought it was possible to occlude all of the aneurysms in one session by endovascular method. The patient's neurological grade and the old age drove us to perform the endovascular coiling of the four aneurysms at the same time. After setting up the electrocardiographic, respiratory and oxygen saturation monitoring, neuroleptic anesthesia was performed by propofol. We do not use systemic heparin solution in ruptured aneurysm, but we used heparin solution (3000 iu per 1 liter normal saline) as the flushing fluid in this patient. Our first target was a large right MCA aneurysm. Excelsior microcatheter (Boston Scientific, Target) was navigated to the large right MCA aneurysm and the microcatheter tip was positioned in this aneurysm under fluoroscopic roadmap guidance. The first

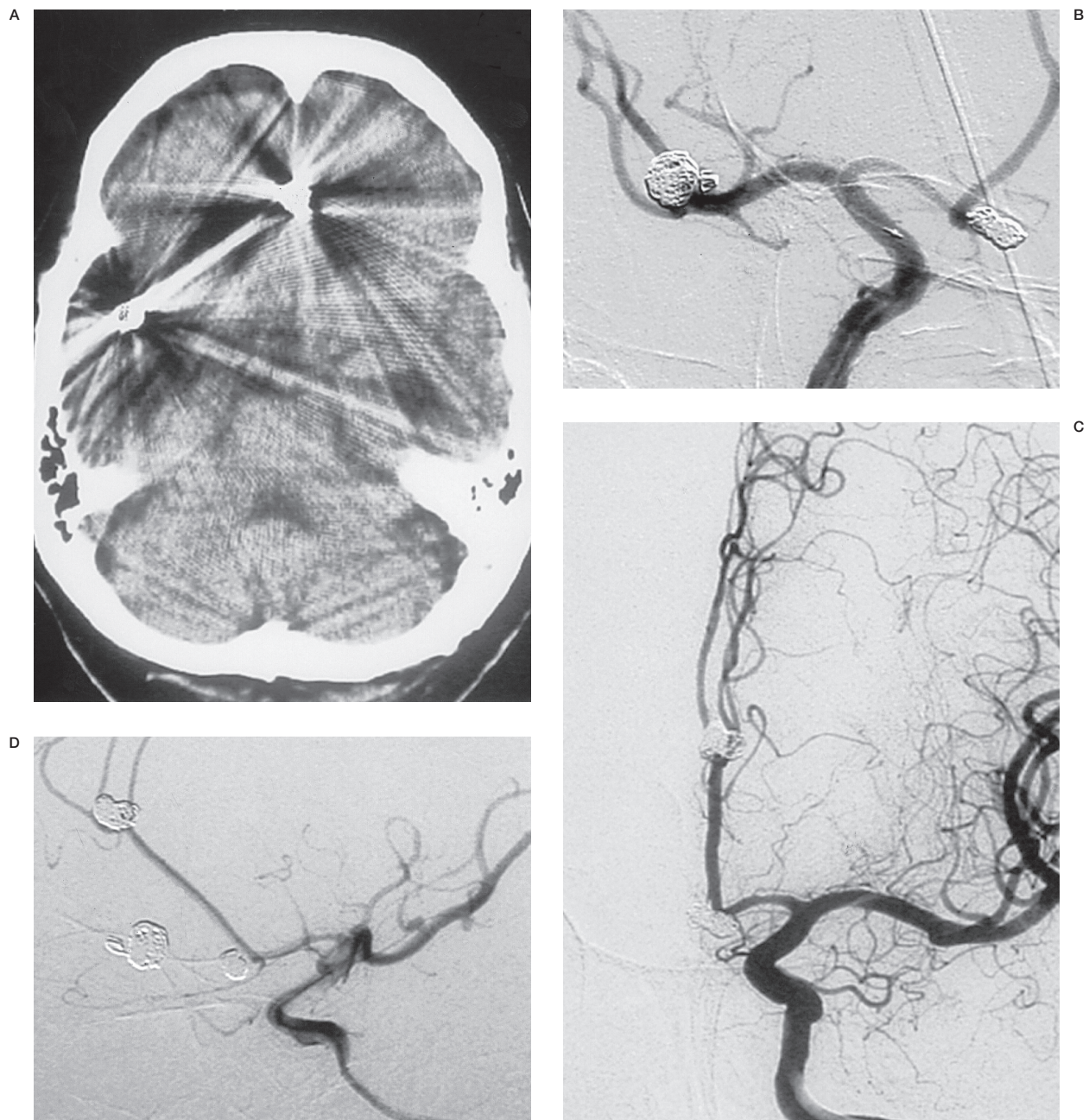


Figure 2 Postoperative radiological findings. A) Brain computed tomography showing coil artifact. B) Right internal carotid oblique angiography showing occlusion of two middle cerebral artery aneurysms and an anterior communicating artery aneurysm. C) Left anteroposterior internal carotid angiography showing occlusion of a left A2 aneurysm. D) Left lateral internal carotid angiography showing occlusion of two right middle cerebral artery aneurysms, anterior communicating artery aneurysm and left A2 aneurysm.

coil was selected and deployed. Coil position within aneurysm and patency of parent vessel was confirmed angiographically prior to every coil detachment. Further coils were continued filling at right the MCA larger aneurysm sac.

After successful occlusion of right MCA larger aneurysm, we were able to occlude all other aneurysms at one session (figure 2). Post embolization day 103, she was discharged from our hospital with moderate neurological sequelae.

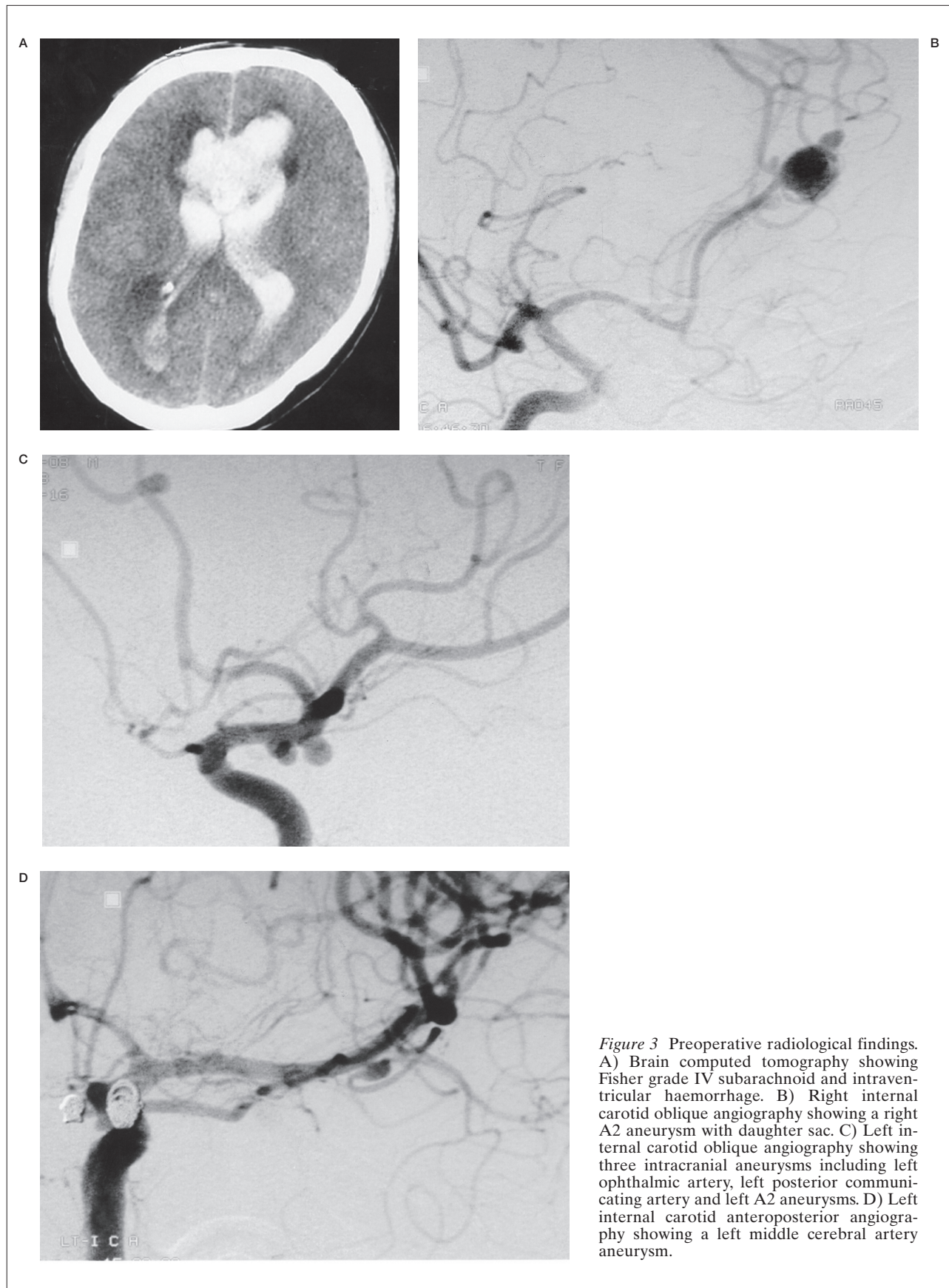


Figure 3 Preoperative radiological findings. A) Brain computed tomography showing Fisher grade IV subarachnoid and intraventricular haemorrhage. B) Right internal carotid oblique angiography showing a right A2 aneurysm with daughter sac. C) Left internal carotid oblique angiography showing three intracranial aneurysms including left ophthalmic artery, left posterior communicating artery and left A2 aneurysms. D) Left internal carotid anteroposterior angiography showing a left middle cerebral artery aneurysm.

Case 2.

A 55-year-old male was admitted with a semicomatose mental state. Brain CT finding was Fisher grade IV subarachnoid haemorrhage with ventricular haemorrhage and main intracerebral haemorrhage location was near the A2 portion of ACA (figure 3).

DSA revealed five intracranial aneurysms, including right A2 of ACA, left A2 of ACA, left ophthalmic artery, left posterior communicating artery (PCoA), and left MCA aneurysms (figure 3). The size of aneurysms were 10 x 10 mm in right A2 of ACA, 3 x 4 mm in left ophthalmic artery, 4 x 5 mm in left PCoA, 3 x 4 mm in left MCA, and 3 x 4 mm in left A2 of ACA. We expected that ruptured aneurysm was the right A2 aneurysm because of the main intracerebral haemorrhage location near the A2 portion on brain CT a daughter sac and largest size on DSA. The same endovascular procedure was performed as in case 1.

After successful first occlusion of right A2 aneurysm, we were able to occlude all aneurysms at one stage by Guglielmi detachable coil (GDC) (Boston Scientific, Target) embolization (figure 4). Post-embolization CT showed persistent intraventricular haemorrhage, requiring extraventricular drainage. Post-embolization day 63, he was discharged from our hospital with minimal neurological deficit.

Discussion

Multiple intracranial aneurysms are associated with embryological, and haemodynamic factors¹. Risk factors for multiple intracranial aneurysms may be the same as for aneurysm formation in general.

Hypertension, smoking, a family history of cerebrovascular disease, postmenopausal female sex, arterial deficiency in collagen type III, viral infection, and certain HLA-associat-

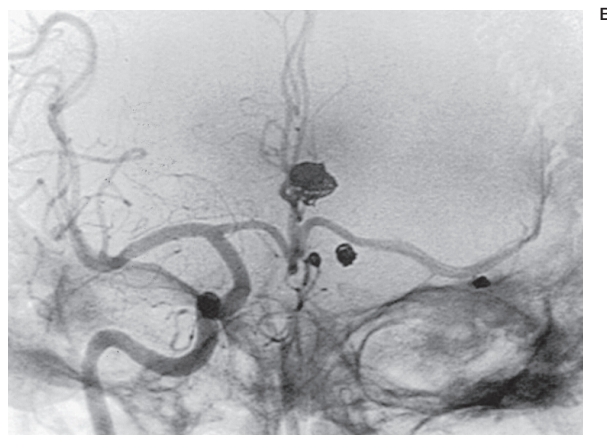
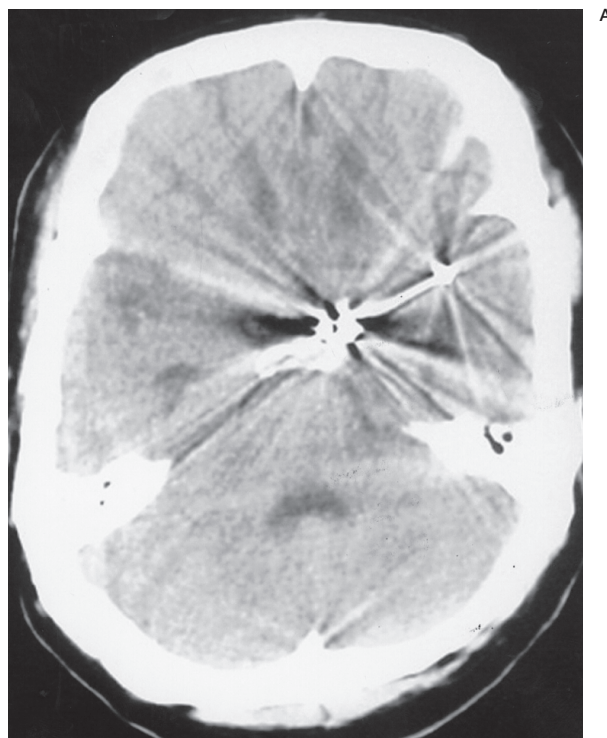


Figure 4 Postoperative radiological findings. A) Brain computed tomography showing multiple coil artifact. B) Right internal carotid anteroposterior angiography during the compression of left internal carotid artery, showing occlusion of right A2, left ophthalmic artery, left posterior communicating artery and left middle cerebral artery aneurysms. C) Left lateral internal carotid angiography showing occlusion of five intracranial aneurysms, including right A2, left A2, left ophthalmic artery, left posterior communicating artery and left middle cerebral artery aneurysms.

ed factor and several congenital factors are related to the formation of multiple intracranial aneurysms^{1,3,4,5}.

In our cases, the related factor for multiple intracranial aneurysms are postmenopausal female sex and hypertension history in case 1, but case 2 is not related to these factors.

Generally, early treatment of the ruptured aneurysm eliminates the risk of rebleeding, and maximal effort can be focused on postoperative care and the treatment of vasospasm¹⁴. Numerous aneurysms with subarachnoid haemorrhage are defined as the combination of at least one ruptured and other silent aneurysms. Although we expect to find the ruptured site through radiologic findings, for example brain CT, angiographic view, among numerous aneurysms, misdiagnosis requires a second surgical approach during the acute phase, a contributing factor to poor outcome^{8,14}.

There are various factors suggesting the rupture site, for example, the main haemorrhage location in brain CT, and size and shape of aneurysm in DSA findings and clinical localizations. However, sometimes experienced neurosurgeons missed diagnosis of rupture site among numerous aneurysms. Options regarding surgical strategy for numerous intracranial aneurysms are unsettled. These have varied from non-operation for unruptured aneurysms to operation only on unruptured aneurysms that can be reached via the same craniotomy as for the ruptured aneurysm. In the case of non-operation of unruptured aneurysm, multi staged operations can be performed with low morbidity and mortality only if the ruptured aneurysm has already been clipped. But, in the report of Rodriguez et Al¹², untreated unruptured aneurysms among numerous aneurysms bled at a rate of 3% per year, with a cumulative mortality rate of 20%. Especially, small cerebral aneurysms can produce more severe subarachnoid haemorrhage¹³. In the case of only treated in ruptured aneurysm, triple H therapy for vasospasm carries the potential risk of rupturing an untreated aneurysm. Therefore, unruptured aneurysms should be considered to be treated actively. In numerous aneurysms, the best treatment is the occlusion of all of the aneurysm, either by surgical or endovascular method. Many articles report that surgery of the numerous aneurysms had a worse outcome than a single aneurysm^{1,4,14}. Because multiple operations car-

ry many risks, for example, risk of multiple general anesthesia, risk of several craniotomies, risk of brain retraction injury, and risk of multiple surgical manipulation of brain¹⁶.

Unfortunately, the literature suggests that there is no clear-cut strategy regarding the optimal management of numerous intracranial aneurysms⁶. The introduction of GDC coil has made it possible to treat aneurysms effectively in one session by endovascular methods⁹. GDC coiling of intracranial aneurysm has gained acceptance for poor surgical candidates¹⁶. Difficulties may be created by accessibility of microcatheter and size of aneurysm neck rather than location. Benefit of the endovascular method for treatment of numerous intracranial aneurysms is the elimination of the hazard of not treating the aneurysm responsible for rebleeding¹⁴. By use of this technique, all aneurysms can be embolized at one session. Even though all aneurysms are occluded in one session, the ruptured aneurysm should be treated first.

This eliminates the risk of rehaemorrhage and provides the options of treating additional aneurysms in a second session either by embolization or surgery in case of technical difficulties. It is controversial from the beginning of the era of endovascular treatment of intracranial aneurysms, whether to treat more than one aneurysm in acute stage or not. There is no question in treating multiple aneurysms in cases that the ruptured one could not be determined. It is not a general practice to treat all aneurysms including small ones obviously unruptured in acute stage, especially in elderly patients and it may be wiser to minimize any risks related endovascular treatment. When patients have recovered from haemorrhage other aneurysms can be treated effectively. If concerned of rupture of untreated aneurysm due to haemodynamic stress of hypertensive therapy, it is reasonable to treat large aneurysms, but not very small aneurysms. We coiled in one session in two cases all aneurysms demonstrated by GDC in one stage.

Conclusions

Almost all multiple intracranial aneurysms are two or three aneurysms. Above four numerous intracranial aneurysms are extremely rare.

Regardless of aneurysmal location, all nu-

merous intracranial aneurysms can be occluded in one stage by endovascular method. Risk of rebleeding can be avoided in the case of mistakenly treating only one unruptured aneurysms.

The best way would be the occlusion of all of the intracranial aneurysms at one session. Therefore, embolization of numerous intracranial aneurysms by using GDC is a more effective therapeutic strategy than surgical method.

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